ENVIRONMENTAL CONDITIONS

HYDROLOGY

Folsom Lake State Recreation Area

April 2003

by

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Introduction

Psomas and Geotechnical Consultants, Inc. (GTC) prepared this section to describe the existing hydrologic and groundwater conditions within the Folsom Lake State Recreation Area (the Unit). The purpose of this summary is to:

- Describe the existing hydrologic conditions within the Unit
- Provide hydrographs and Rosgen classifications of rivers and streams (where available)
- Describe existing dams, hydropower plants, and flood control projects and future projects as to how they affect the Unit
- Identify the minimum, maximum and average lake levels by month
- Describe the existing groundwater conditions within the Unit

The information for this section was gathered from the California Department of Water Resources (DWR), the United States Bureau of Reclamation (BOR), the United States Army Corps of Engineers (ACOE), the Sacramento Area Flood Control Agency (SAFCA), and the National Water Information Service (NWIS, a subdivision of the U.S. Geological Survey). A list of the specific documents reviewed and websites accessed is provided in the reference section.

Watershed Description

Basin Hydrology

The American River watershed covers approximately 2,100 square miles northeast of Sacramento (Figure H-1). The watershed spans portions of three different counties: Sacramento, El Dorado, and Placer. The average annual runoff is approximately 2.7 million acre-feet. In the past, annual runoff has varied from 900,000 acre-feet to 5,000,000 acre-feet. The American River watershed, including all its tributaries, is divided into three major subbasins, the North Fork American River, the South Fork American River and the Lower Fork American River.

The Lower Fork American River subbasin begins at Folsom Dam and extends 30 miles downstream to the mouth of the American River at the confluence of the Sacramento River. The Lower American Basin contains eight dams and has 380 miles of naturally occurring waterways. The precipitation in the Lower American River basin averages 20.83 inches per year (ACOE, 2002).

The North Fork American River subbasin is located above Folsom Lake to the northeast. The basin contains 28 dams, has an annual average precipitation of 58.72 inches, and contains 1,318 miles of naturally occurring waterways (ACOE, 2002).

The South Fork American River subbasin is located east of Folsom Lake and includes the watershed for the Middle and South Forks of the American River. The basin contains 29 dams, has an annual average precipitation of 49.5 inches per year, and contains 1,145 miles of naturally occurring waterways (ACOE, 2002).

The majority of runoff in the basin is generated during the winter months (October -April). From April to July, rainfall runoff is replaced with snowmelt from the upper portions of the American River watershed. A more detailed description of the meteorological conditions in the Unit is provided in the Meteorology/Air Quality Section of this Resource Inventory.

Folsom Dam regulates runoff from a drainage area within the American River watershed, an area of about 1,875 square miles. The normal full-pool storage capacity of Folsom Lake is 975,000 acre-feet, with a seasonally designated flood control storage space of 400,000 acre-feet. If the proposed ACOE dam-raising project occurs, the flood control storage space of Folsom Lake will increase by 95,000 acre-feet (ACOE, 2002)

The Folsom Lake area lies within the Sacramento River Basin California Department of Water Resources Hydrologic Unit. The Folsom Lake hydrologic subarea designation is A06.A1. Lake Natoma and the surrounding area is designated A05.B1. The area upstream of Folsom Lake including the North and South Forks of the American River is hydrologic unit A06.A2 (Department of Water Resources, 1981).

Creeks around Folsom Lake

Several small creeks flow directly into Folsom Lake and Lake Natoma. Major creeks include Willow Creek, Alder Creek, Hinkle Creek, Mormon Ravine (fed from Newcastle Powerhouse releases and Placer County Water Agency surplus canal water), New York Creek, Hancock Creek, Sweetwater Creek, Kelly Ravine, Pilot Creek, Cooper Canyon, Anderson Creek, Indian Springs Creek, Deep Ravine, Knickerbocker Creek, and Skunk Canyon. A description of each of these major creeks is included below in Table H-1: Description of Major Creeks within the Unit. The hydrology of the Unit including the creeks and streams is mapped in Figures H-1a and H-1b.

Table H-1: Description of Major Creeks within the Unit

Creek Name	Discharge Point	Watershed Area (Acres)	Description
Willow Creek	Lake Natoma	2,700	"Highly Urbanized" by the City of Folsom; perennial.
Alder Creek	Lake Natoma	1,900	Lower reach – Commercial; Upper reach – Aerojet land and dredging piles; Rapidly developing East Folsom area drains into Alder Creek;
Hinkle Creek	Lake Natoma	1,000	Mostly rural housing and pasture lands; perennial.
Mormon Ravine	American River – North Fork	5,100	Some agricultural areas; seasonal
New York Creek	American River – South Fork	4,900	Some development in upper reaches; perennial
Sweetwater Creek	American River – South Fork	700	No significant development; seasonal
Kelly Ravine	American River – North Fork	4,300	No significant development; seasonal
Pilot Creek	American River – North Fork	500	No significant development; seasonal
Cooper Canyon	American River – North Fork	1,600	No significant development; seasonal
Anderson Creek	American River – North Fork	1,300	No significant development; seasonal
Indian Springs Creek	American River – South Fork	800	No significant development; seasonal
Deep Ravine	American River – South Fork	400	No significant development; seasonal
Skunk Canyon	American River – South Fork	2,200	No significant development; seasonal
Knickerbocker Creek	American River – North Fork	300	No significant development; seasonal

Figure H-1a: Unit Hydrology (Folsom Lake)

Figure H-1b: Unit Hydrology (Lake Natoma)

Unfortunately, no USGS streamflow gauging stations are located on these major creeks; therefore, hydrographs are not available for these systems. Compared to the size of the American River Basin, these creeks are small and do not individually impact the hydrology of Folsom Lake. Creeks in the vicinity of the Unit are being impacted by the increasing amount of urban development in the area. Urban development creates impervious surfaces (rooftops, roadways, sidewalks) that prevent water (rainfall) from filtering into the ground. Added impervious surface increases stormwater runoff rates and volumes, which can instigate streambank erosion. Runoff associated with housing, roads and commercial development within nearby watersheds can negatively impact water quality by contributing sediment, petroleum residue, lead, zinc and other nutrients to the Unit's creeks and streams. During the summer months, landscape irrigation runoff from adjacent urban development can further increase stream flow rates and volumes and impact water quality by contributing nutrients from fertilized landscaping and bacteria from animal waste to the Unit's creeks and streams. A discussion of the water quality characteristics and concerns within the Unit is included in the Water Quality section of this Resource Inventory.

Hydrographs

The 100-year storm hydrograph for flow in the American River just downstream of Folsom Dam is shown in Figure H-2. The hydrograph was taken from the United States Army Corps American River Water, California Long-Term Study (ACOE. 2002.). The hydrograph also shows the impacts of the Folsom Dam Modification Project and the Folsom Dam Raise Project proposed by the ACOE.

As shown in the hydrograph, flows during a 100-year storm could exceed 350,000 cfs. During storm events, Folsom Dam would release 115,000 cfs. During a flood event (1 in 2 chance of occurring in any year), flows in the Lower American River could reach 40,000 cubic feet per second (cfs) if unregulated. Flood control storage within Folsom Dam would prevent flows from exceeding 25,000 cfs. During major flood events (between a 1-in-18 and 1-in-120 chance of occurring in any year), flows could reach between 160,000 cfs and 375,000 cfs if unregulated. Flood control storage within Folsom Dam would prevent flows from exceeding 115,000 cfs.

Figures H-3 through H-5 show mean monthly streamflows for the three major contributors to Folsom Lake, the North, Middle and South Forks of the American River. Hydrographs for these forks are shown in Figures H-6 through H-8.

Flood Maps

Storm events in 1986 and 1987, caused record flood flows and precipitation peaks in the American River Basin. Outflows from Folsom Lake combined with high flows on the Sacramento River resulted in water levels reaching the safety capacity of the levees that protect metropolitan Sacramento. These events raised significant concern over the adequacy of the existing flood control system and led to a series of investigations by the Sacramento Area Flood Control Agency (SAFCA), the ACOE, the State Reclamation Board and the Federal Emergency Management Agency (FEMA) into the need for improved flood protection for the Sacramento area (ACOE, 2002).

Early floodplain maps adopted by FEMA showed that the majority of flows generated by a 100-year storm could be contained within Folsom Lake with some flooding on the

Figure H-2: Hydrograph – American River Hydrograph

Figure H-3: Streamflow Graph– North Fork

Figure H-4: Streamflow Graph – Middle Fork

Figure H-5: Streamflow Graph – South Fork

Figure H-6: Hydrograph – North Fork

Figure H-7: Hydrograph – Middle Fork

Figure H-8: Hydrograph – South Fork

northwestern side of the Lake where numerous CDPR recreational facilities exist. No major flooding would occur around Lake Natoma. Recent studies conducted by the ACOE have determined that earlier hydrologic studies of the American River are inaccurate and that existing FEMA floodplain maps are invalid. According to this new information (ACOE, 2002.), Folsom Dam can only provide flood protection for a 63-year storm event. A 100-year storm event would likely overtop the dam and cause extensive flooding around Folsom Lake, Lake Natoma and the Sacramento area. The ACOE and FEMA are currently in the process of updating floodplain maps based upon these new hydrological studies. Improvements related to the Folsom Dam Modification Project and the potential implementation of the Folsom Dam Raising Project will impact these maps. The FEMA Map is provided as Figures H-9a and H-9b.

Key to FEMA Map

Zone ANI	An area that is located within a community or county that is not mapped on any published FIRM (Area not included)
Zone A	An area inundated by 100-year flooding, for which no BFEs have been determined
Zone D	An area of undetermined but possible flood hazard
Zone X500	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1-foot or with drainage area less than 1 square mile; or an area protected by levees from 100-year flooding.
Zone X	An area that is determined to be outside the 100- and 500-year floodplains

Figure H-9a: FEMA Map (Folsom Lake)

Figure H-9b: FEMA Map (Lake Natoma)

The Folsom Dam Modification Project, authorized by the United States Congress in 1999, is intended to reduce the probability of flooding in Sacramento in any year from 1 chance in 85 to 1 chance in 140 (ACOE, 2002). The first phase of the project will involve enlarging eight existing river outlets at Folsom Dam to permit increased capacity. Construction is expected to begin in early 2003 and be completed in about six years. In addition to the outlet modification, the ACOE will modify the use of surcharge storage in Folsom Lake – using both operational and physical means – to allow non-damaging releases to occur at Folsom Dam while allowing water levels in Folsom Lake to reach up to 474 feet (ACOE, 2002). Change to existing emergency release operation would reflect the new flood surcharge elevation of 474 feet for releases. Physical modifications to the dam itself would include replacement of three emergency spillway gates to allow an additional 3 feet of headroom above the new flood surcharge elevation of 474 feet (ACOE, 2002). In addition, an advance release strategy will be developed based on improved weather forecasts using the Advanced Hydrologic Prediction System of the National Weather Service. Under this strategy, the BOR would act on a five-day forecast of high flow to increase releases and accommodate incoming flood volumes.

Despite the improvements associated with the Folsom Dam Modification Project, the ACOE, BOR, and SAFCA have determined that Folsom Dam will not meet current federal dam safety standards without failure. As a result, these agencies have proposed to raise Folsom Dam by seven feet and increase the maximum flood pool water elevation from 474 feet to 482 feet (ACOE, 2002), effectively adding 95,000 acre-feet of storage capacity to Folsom Lake. This increased storage capacity would reduce the probability of flooding in Sacramento in any year to 1 chance in 213.

Dams within the Unit

There are two major dams within the Unit, Nimbus Dam on Lake Natoma and Folsom Dam on Folsom Lake. Both of these dams are operated by the BOR and were constructed as part of the Central Valley Project.

Nimbus Dam

Constructed in 1955, Nimbus Dam is almost 1,100 feet in length and 76 feet in height. Construction of the dam created Lake Natoma. Located immediately downstream of Folsom Lake, Lake Natoma serves as a regulating afterbay to stabilize flow releases to the Lower American River. Flows entering Lake Natoma from Folsom Lake can fluctuate widely as Folsom Dam responds to power generation needs. Daily water surface elevations in Lake Natoma typically fluctuate between four and seven feet. Lake Natoma is also the point of diversion for water in the Folsom South Canal. The completed portion of the Folsom South Canal extends from Nimbus Dam 27 miles south. In addition, Lake Natoma is used for water quality and temperature control that is essential to the preservation of spawning habitat for anadromous fish in the Lower American River and the success of the Nimbus Hatchery. The Nimbus Hatchery, located approximately 0.25 miles downstream of Lake Natoma, is operated and maintained by the California Department of Fish and Game and funded by the BOR. The hatchery spawns and rears chinook salmon and steelhead to compensate for the loss of 100 miles of upstream spawning and rearing habitat resulting from the construction of Folsom Dam.

Lake Natoma, with a storage capacity of 8,760 acre-feet, cannot provide significant flood storage and therefore has little effect on the flood hydrology of the American River. However, an adequate regime of flows and water temperatures from Folsom Lake and Lake Natoma are essential for creating favorable conditions for downstream populations of chinook salmon and steelhead. Carefully controlled water releases from Lake Natoma must balance fisheries needs with the demands for power generation, water supply deliveries, and Delta water quality standards. The Nimbus Dam Powerplant releases approximately 5,100 cfs. The Nimbus Dam Powerplant has two power generating units – each with a capacity of approximately 2500 cfs.

Folsom Dam

Folsom Dam, constructed in 1956, is located on the American River approximately 30 miles upstream of its confluence with the Sacramento River. Folsom Dam is 1,400 feet long and 340 feet high (CDPR website). The Folsom Lake reservoir provides flood protection for the Sacramento area; water supplies for irrigation, domestic, municipal, and industrial uses; power generation; and water-related recreational opportunities. In addition, Folsom Dam and Reservoir were designed to control water quality in the Sacramento Delta and are used to maintain flows that balance the needs of wildlife habitat, fish, and recreational use in and along the Lower American River (ACOE, 2002, Ch. 2).

Folsom Lake provides flood protection by storing extreme inflows and limiting outflows. The mean inflow to Folsom Lake is 2.4 million acre-feet per year. During normal operating conditions, Folsom Lake has a capacity to hold 975,000 acre-feet of water. At the elevation of the dam spillway, 475.4 feet, the lake has a maximum capacity of 1,120,200 acre-feet. Of the total capacity, up to 400,000 acre-feet is dedicated to flood control storage. Peak inflow during a 100-year storm event is approximately 353,537 cfs (ACOE, 2002). A flow of this magnitude would cause significant flooding and property damage in the American River basin downstream. During storm events, outflows are limited to 115,000 cfs to prevent such flooding and related property damage.

Due to the large volume of flood control storage available, Folsom Lake is a significant factor in flood control management for the Sacramento area. Due to its proximity to the Delta, the lake is also a key source of the Delta's water supply. Water released from Folsom Lake can quickly alleviate water supply and fish flow demands in the Delta.

Dams Upstream of the Unit

Multiple smaller dams and reservoirs are located in the American River upstream of the Unit. These dams were created for hydropower plants. The major reservoirs are summarized in Table H-1.

According to the ACOE, the 47,000 acre-feet of available flood control storage from these reservoirs is insufficient to capture the amount of runoff generated within the American River Basin (ACOE. 1992.). As such, these reservoirs do not provide a significant level of flood protection nor greatly impact the hydrology of the American River during large storm events. Furthermore, these reservoirs regulate only 14 percent of the drainage area and are disproportionately concentrated in the upstream area of the Middle Fork of the American River.

These reservoirs impact the hydrology of the American River by helping to mitigate the potential for reduced flows in the summer when rainfall is low and water supply and power generation demands are high. Water releases from these upstream reservoirs combined with

Table H-2: Major Reservoirs in the Upper American Drainage Area

Reservoir	Stream/American River Tributary	Owner[1]	Elev. Top of Dam (ft)	Capacity (ac-ft)
Lake Clementine	North Fork	COE	716	10,600
French Meadows	Middle Fork	PCWA	5271	133,700[2]
Hell Hole	Rubicon Riv/Middle Fork	PCWA	4650	208,400
Stumpy Meadows	Pilot Creek/Middle Fork	GDPUD	4272	20,000
Loon Lake	Gerle Creek/Middle Fork	SMUD	6418	76,500
Union Valley	Silver Creek/South Fork	SMUD	4578	271,000[2]
Ice House	South Fork Silver Creek/ South Fork	SMUD	5454	45,960[2]
Slab Creek	South Fork	SMUD	1870	16,600
Cables Lake	Caples Creek/ South Fork	PG&E	7960	21,581
Silver Lake	Silver Fork/South Fork	PG&E	7211	3,800
Ralston After Bay	Rubicon Riv/ Middle Fork	PCWA	1189	850
Chili Bar	South Fork	PG&E	1029	3,700
Gerle Div Dam	Gerle Creek/ South Fork	SMUD	5240	1,380
Junction Div Dam	Silver Creek/ South Fork	SMUD	4468	3,250
Camino Div Dam	Silver Creek/ South Fork	SMUD	2918	845 [3]
Rubicon Sp.	Middle Fork	SMUD	6251	1,450
Oxbow	Middle Fork	PCWA	--	2,800
	TOTAL			822,416

[1] COE - Corps of Engineers
PCWA – Placer County Water Agency
GDPUD – Georgetown Divide Public Utility District
SMUD – Sacramento Municipal Utility Water District
PG&E – Pacific Gas and Electric Company

[2] Effective storage is reduced during winter months for dam safety.

those from Folsom Lake and Lake Natoma ensure adequate flows are available to meet fisheries needs as well as demands for power generation and water supply deliveries.

Hydropower Plants within the Unit

Three hydropower plants are located within the Unit, the Newcastle Powerhouse at Mormon Ravine, the Folsom Dam Powerhouse and the Nimbus Dam Powerhouse. PG&E operates the Newcastle Powerhouse. The BOR operates both the Folsom Dam and Nimbus Dam Powerplants, which were constructed as part of the Central Valley Project.

Numerous hydropower plants exist outside of Unit boundaries in the upper portions of the American River Basin. However, a detailed description of these facilities has not been included as part of this Resource Inventory.

Newcastle Powerhouse at Mormon Ravine

The Newcastle Powerhouse, operated by PG&E, is located off of Rattlesnake Road near Mormon Ravine. The powerhouse is on the north side of the North Fork of the American River, approximately 4 miles downstream of where the North Fork enters into Folsom Lake. The plant was constructed in 1986 and has a maximum operating capacity of 11.5 Megawatts (MW).

The hydroplant generates electricity using surplus raw water from Placer County Water Agency (PCWA) canals. Outflow from the single penstock (sluice or gate to control water flow) flows through the South Canal and into Folsom Lake. Since the water supply from PCWA is limited during times of the year, PG&E does not operate the plant at full capacity year round nor does PG&E have any plans to expand this plant. Compared to the releases from the Nimbus and Folsom Dam Powerhouses, water outflow from the plant is negligible.

The powerhouse transmission line connects to the PG&E owned Placer-Goldhill transmission line near the beginning of Rattlesnake Bar Road on the Peninsula. The Placer-Goldhill transmission line runs along the east side of Folsom Lake and is discussed in more detail in the Utilities Section of this Resource Inventory.

Folsom Dam Powerplant

The Folsom Dam Powerplant, operated by the BOR, was completed in 1956 with the construction of Folsom Dam. Three separate penstocks in the dam feed three generating units which produce up to 215,000 kW (WAPA 2000) of power. Power is distributed by the Western Area Power Administration (WAPA).

Water releases associated with powerplant operation are highly variable with a maximum outflow of 8,603 cfs (WAPA, 2000). The Folsom Dam Powerplant provides supplemental power supply during hours of peak demand. When electrical demands are low, powerplant operation is not necessary and therefore, no water releases occur (ACOE, 2002).

The Folsom Dam Powerplant is a significant source of electrical energy for Northern California. The plant was constructed as part of the Central Valley Project in which eight hydropower plants and several water supply reservoirs were constructed to provide up to 2.044 million kW of electricity (ACOE. 2002). These hydropower plants account for 16% of the total energy generated within the State of California. The Folsom Dam Powerplant accounts for approximately 2% of California's total power generating capability.

The operation of the powerplant is critical to meeting California's energy needs. Despite this, no current plans to expand the power facility exist. However, the continued growth of California and the demand for power may increase pressure to expand this facility in the future.

Nimbus Dam Powerplant

The Nimbus Dam Powerplant, operated by the BOR, was completed in 1955 with the construction of Nimbus Dam and was part of the Central Valley Project Two penstocks in the dam feed two generating units which produce up to 17,000 kW (WAPA, 2000) of power. Power is distributed by the WAPA. According to the Western Area Power Administration (WAPA 2000), the maximum flow of water that the power plant can release is 5,100 cfs. Powerplant releases are not as variable as releases from the Folsom Dam Powerplant. This is due to the fact that the powerplant is operated continuously throughout the day (ACOE 2002).

Water releases associated with powerplant operation are not as variable as releases from Folsom Dam Powerplant because the Nimbus Dam Powerplant is operated continuously throughout the day (ACOE, 2002). Maximum flow of water release is 5,100 cfs (WAPA, 2000).

The Nimbus Dam Powerplant is not a significant source of electrical energy. It accounts for less than 1% of the 2.044 million kW of electricity generating capacity of the eight hydropower plants in the Central Valley Project. The powerhouse accounts for less than 0.14% of the total energy generated within the State of California.

No plans to expand the power facility currently exist. However, the continued growth of California and the demand for power may increase pressure to expand the facility in the future. Expansion of the facility is constrained by a lack of available land and restrictions on the outflow from Lake Natoma.

Major Water Diversions within the Unit

Several water agencies and entities hold entitlements to water from the American River. Major water users are listed in Table H-2. The contract amount represents the total water allotment each agency may obtain through its contract with the Central Valley Project. Most agencies are taking only a portion of the water to which they are entitled to (see the 1990 Deliveries amounts in the table). As California continues to grow, demand for water from the American River will also increase.

Table H-3: American River Central Valley Project Contracts and Deliveries[1]

Contracting Entity	Contract	1990
North Area Water Rights		
Natomas Diversions (Folsom and Southern California Water Co.)	32.0	18.0
North Fork Ditch (SJWD)	33.0	33.0
Folsom Prison	4.0	1.0
Subtotal	**69.0**	**52.0**
El Dorado Diversions		
El Dorado County CVP Water	25.8	25.0
El Dorado Water Rights	4.7	4.0
Subtotal	**30.5**	**29.0**
Others		
Placer County CVP Water	117.0	0.0
Placer County Water Rights	120.0	9.0
San Juan Water Dist. CVP Water	11.2	11.2
City of Roseville	32.0	11.0
FSC-Sacramento County Irrigation	0.0	10.0 [3]
FSC-EBMUD	150.0	0.0
FSC-SMUD (60,000 ac-ft of CVP Water)	75.0	12.0
FSC-Losses	20.0	20.0
City of Sacramento	230.0	50.0
Carmicheal Irrigation Dist. & Riparian	56.0	0.0
Subtotal	**811.2**	**123.2**
Total	**910.7**	**204.2**

Note: FSC = Folsom South Canal

DMC = Delta-Mendota Canal

SLC = San Luis Canal

SJWD = San Juan Water District

SMUD = Sacramento Municipal Water District

CVP = Central Valley Project

[1] Source: USBR, Mid-Pacific Region

[2] Amounts are in 1,000 ac-ft.

[3] Interim Water Contracts

Of the water agencies mentioned above, only a portion of them take water directly out of Folsom Lake or Lake Natoma. Total water supply demands from Folsom Lake equal roughly 140,000 acre-feet per year (ACOE 2002). Total water supply demands from Lake Natoma equal approximately 20,000 acre-feet per year via the Folsom South canal (ACOE 2002). Water supply demands from the lower part of the American River, downstream from Lake Natoma, equal approximately 105,000 acre-feet.

Major diversions out of Folsom Lake and Lake Natoma are summarized in Table H-3. Water users not mentioned in the table obtain water from either the American River downstream from Lake Natoma or through the Sacramento Delta.

Existing water diversions do not significantly impact the hydrology of Folsom Lake or Lake Natoma on a regular basis. If all water agencies began to take their full allotment of water, the availability of water in the American River would be significantly impacted. To receive their full allotment of water, each agency would likely be required to undergo an environmental review and application process.

At times, existing water diversions from the American River do impact the hydrology of the American River, especially during the summer months when rainfall is low and irrigation demands are higher. These impacts are exacerbated when water from Folsom Lake is used to alleviate water fluctuation problems in the Delta (WAPA 2000).

Table H-4: Folsom Lake SRA Existing Diversion Points and Service Areas

Diversion Point	Service Area
Folsom Lake Dam	San Juan Water District (Citrus Heights Irrigation District) (Orangevale Mutual Water District) (Fairs Oaks Water District) (Placer County Water Agency) City of Folsom Folsom Prison City of Roseville
Folsom Lake at the South Fork Arm	El Dorado Irrigation District
Folsom South Canal out of Lake Natoma	Arden Cordova Water District Omochumne Hartnell Water District Galt Irrigation District Clay Water District Sacramento Municipal Utility District Sacramento County Water Agency, portions Mather Air Force Base EBMUD

Source: ACOE, 1992

Lake Levels

The monthly minimum and average lake levels for Folsom Lake and Lake Natoma are summarized in Table H-4 below. The data was analyzed using daily lake levels from October 1, 1975 through February 25, 2003. All elevations are given in feet above sea level. Lake level data was provided by the Central Valley Operations division of the BOR and was analyzed and compiled by Psomas.

Table H-5: Folsom Lake and Lake Natoma Lake Levels by Month (10/1/1975 through 2/25/2003)

Month	Folsom Lake			Lake Natoma		
	Minimum Lake Level	Maximum Lake Level	Average Lake Level	Minimum Lake Level	Maximum Lake Level	Average Lake Level
January	351.99	455.65	411.26	120.65	125.40	123.55
February	352.25	465.74	415.85	120.67	125.80	123.56
March	356.76	451.59	424.18	121.09	125.83	123.64
April	382.71	461.44	434.41	120.41	125.80	123.63
May	384.98	464.91	441.67	120.76	125.60	123.71
June	376.45	465.51	444.18	120.68	125.60	123.77
July	364.73	465.42	435.21	121.26	125.60	124.05
August	354.80	461.30	423.38	120.10	125.50	123.92
September	349.58	452.59	417.66	120.63	125.80	123.76
October	348.82	443.73	411.59	118.48	125.40	123.85
November	347.56	442.60	405.69	120.16	125.70	123.73
December	349.41	447.05	405.24	120.58	125.40	123.70

Although the primary function of Folsom Dam is flood control, the reservoir stores water for irrigation and domestic use and for electrical power generation. The dam also plays a role in the preservation of the American River fishery and the downstream control of salt-water intrusion in the Sacramento-San Joaquin Delta. Lake levels can fluctuate significantly depending on hydrological and meteorological conditions, water demands and flood control and hydropower needs, however water levels are largely dictated by water supply and flood protection releases. Lake levels normally vary from about 466 feet in early summer to about 406 feet in early winter.

Lake Natoma is a regulating afterbay used to modulate flow fluctuations from the Folsom Powerplant into the American River and to generate electricity from water releases. The water levels in Lake Natoma can be controlled via releases from Folsom Lake. As a result, water levels in Lake Natoma do not vary significantly (between four and seven feet) and are not sensitive to variations in hydrological and meteorological conditions.

Future Projects

There are four major flood control or water supply projects that will impact the water resources and hydrology within the Unit, the El Dorado Irrigation District Raw Water Intake expansion, the San Juan Water District Peterson Water Treatment Plant expansion, the Folsom Dam Modification Project, and the Folsom Dam Raise Project.

El Dorado Irrigation District Raw Water Intake Expansion

The El Dorado Irrigation District plans to expand the existing water intake facility on the South Fork of the American River. The intake facility, located near the end of Planeta Way, includes water intake pipelines, a surge tank and a building that houses the pump station and electrical controls. The entire facility is located within the Unit on BOR property. The Irrigation District also has an easement for an existing 30” raw water line from the intake facility.

The Irrigation District plans to expand the intake facility by replacing five existing separate intake lines with one nine- foot diameter intake structure. In addition, the Irrigation District will expand the capacity of the intakes and pumps from 20 Million Gallons per Day (MGD) to 48 MGD. A new 42” transmission main will be added parallel to the existing 30” transmission main leaving the intake facility.

The total water demand required by this project is minor compared to the volume of water in Folsom Lake, therefore the expansion project will not significantly affect lake levels or the hydrology of the lake. The project will visually impact the Unit and impart some low-level noise impacts. Easement issues will constrain future development plans within the Unit. Impacts related to this project are discussed in greater detail in the Utilities Section of this Resource Inventory.

San Juan Water District Peterson Water Treatment Plant Expansion

The San Juan Water District plans to expand the Peterson Water Treatment Plant. The Water District has leased Parcel C from the Bureau to provide the required additional space. Impacts related to the Parcel lease acquisition are discussed in greater detail in the Utilities Section of this Resource Inventory. Expansion of the plant will provide a possible replacement water supply for American River groundwater pumping demands in the Sacramento area. The project would supplement winter water supply to help alleviate groundwater demands and allow for more groundwater recharge.

The San Juan Water District obtains water from Folsom Lake via an 84" diameter pipeline from Folsom Dam. The total water demand required by the San Juan Water District is minor compared to the volume of water in Folsom Lake, therefore, this expansion project will not significantly affect lake levels or the hydrology of the Lake.

Folsom Dam Modification Project

As mentioned earlier in this section, heavy storms in February 1986 resulted in a flood higher than any flood previously on record. Precipitation totals for the 1986 storm (which lasted 10 days) were more than half the normal annual rainfall. Significant flooding resulted along the Sacramento and American Rivers.

As a result, the ACOE, in conjunction with other agencies, re-evaluated the hydrology of the American River Basin and the existing flood control system. Using updated storm information and inflow data, the ACOE now believes that the Folsom Dam can only control storm flows for an event with a 63-year recurrence interval. The Folsom Dam Modification Project would increase Folsom Dam's storm flow control capability to handle a 140-year event.

The Folsom Dam Modification project includes improvements to the outlet structures as well as physical and operational modifications to the use of surcharge storage. The maximum flood control release is currently 115,000 cfs. Improvements to the spillway and release outlets would increase flood control release capacity to 160,000 cfs. According to the ACOE, the levees on the American River downstream of the Folsom Dam can now accommodate up to 160,000 cfs due to recent levee improvements (ACOE 2002).

New operation procedures would allow the BOR and the ACOE to control an additional 270,000 acre-feet of water within Folsom Lake and to provide up to 670,000 acre-feet of flood control storage. In addition, an advance release strategy based on improved weather forecasts would allow the BOR to increase releases and accommodate incoming flood volumes based on an accurate five-day flow forecast.

Folsom Dam Raise Project

Despite improvements related to the Folsom Dam Modification Project, the ACOE is proposing to raise Folsom Dam by 7 feet. The dam-raising project would allow for maximum lake levels to increase by up to 8 feet. The main purpose of the project would be to provide greater flood control protection for the Sacramento area.

The Folsom Dam Raise Project would raise the elevation of the top of the dam from 480.5 feet to 487.5 feet. The maximum flood elevation would be increased from 474 feet to 482 feet. The Folsom Dam Raise Project would provide an additional 96,000 acre-feet of flood control storage space. The ACOE currently reserves 400,000 acre-feet of space in the lake for flood control purposes.

Implementation of the Folsom Modification Project and the Folsom Dam Raise Project will cause greater fluctuation in lake levels than currently exists because the BOR would release more water during the winter to allow for increased flood control storage. In addition to greater lake level fluctuation, some of the long term impacts related to these two projects include flooding of several lots in the Mooney Ridge subdivisions, inundation of a majority of existing CDPR facilities around Folsom Lake as well as the Newcastle Powerhouse and, damage to existing vegetation during periods of inundation.

According to Gold Fields District staff, the CDPR and the BOR constructed many of their recreation facilities based on information provided by the ACOE stating that the maximum water operational level would be 466 feet. Given that flood levels associated with a 63-year storm event can currently reach over 474 feet, many buildings and facilities within the Unit could be inundated in such an event. Unit facilities at risk are Beals Point, Observation Point, Browns Ravine, portions of the Peninsula, Granite Bay, Rattlesnake Bar, Old Salmon Falls lower parking lot, Salmon Falls, and part of Skunk Hollow.

The ACOE claims that the long-term operational effects of the dam-raising project would be less than significant (ACOE 2002) because the risk of flood occurrence is low and the inundation period would be brief (1 to 3 days), and would likely occur during the winter months when most vegetation is dormant. According to ACOE claims, the native vegetation is also naturally tolerant of inundation.

Temporary construction impacts would also result from implementation of these two projects. The ACOE has proposed to use excavated dredge tailing material in the construction of the dam raise project. Two potential borrow pits have been identified within the Unit, one at Mississippi Bar and one on the Folsom Peninsula. Vegetation and wildlife habitat located near the Folsom Dam and the proposed borrow pits would be significantly impacted by construction activities. Construction activities would also impact visual and recreation resources in the Unit and create additional noise, traffic, and air quality impacts.

Groundwater

Groundwater is not recognized as a major resource in the area due to the Unit's underlying geology composed of crystalline or nonporous metamorphic rocks. However, within Unit boundaries, minor groundwater resources may be found along fracture zones in the crystalline rocks. Currently, wells are being used to provide water at several locations within the Unit, including Rattlesnake Bar, the Peninsula campground and boat launch, the residences at Nimbus Flat, and the Shadow Glen stables. Fractured aquifers do not generally support high yield wells therefore surface sources will probably be the primary resource for drinking or irrigation water.

Regional aquifers occur west of the region of outcropping metamorphic and granitic rocks. The main resource is the unconfined Holocene alluvium aquifer that thickens to the west, towards the Central Valley. Only three nearby water wells are listed in the California Department of Water Resources database (http://wdl.water.ca.gov/gw/admin/main_menu_gw.asp).

Septic Systems

Soil is thin over most of the Unit area, with bedrock close to – or at the surface in many areas. Successful septic and leach field systems require several hundred square feet of space where fluids can percolate into the ground. As most of the bedrock is fairly non-porous and the soil is thin, there appear to be few areas where successful septic systems or leach fields could be installed in the Unit. Individual assessment of a proposed site using percolation tests would be required to determine if it could support a septic system or leach field. More information regarding the capabilities and constraints of septic and sewer systems within the Unit is provided in the Utilities Section of this Resource Inventory.

High Water Table

The presence of a high water table can interfere with natural drainage, percolation in leach fields, and cause overflow in septic systems. As there is no continuous aquifer in the upper park area, most areas within the site do not experience a high water table. Rather, low areas may become water-logged due to the presence of impermeable material (bedrock) below the soil layer. New development planned for the Unit should consider the local groundwater conditions on a site-by-site basis.

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